

# Hybrid treatment for juxtarenal aortic occlusion: Successful revascularization using iliofemoral semiclosed endarterectomy and kissing-stents technique

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A 53-year-old man with a significant respiratory history waiting for lung transplantation presented with severe bilateral buttock and thigh claudication. Angiography revealed severe stenosis of the left renal artery and total occlusion of the infrarenal abdominal aorta and iliac vessels. Via a bilateral surgical femoral exposure, we performed semiclosed endarterectomy of the iliofemoral vessels and percutaneous transluminal angioplasty stenting of the infrarenal aorta with two Palmaz stents and percutaneous transluminal angioplasty “kissing stents” of the iliac arteries with three Luminexx stents bilaterally. Completion angiography showed successful complete recanalization of the aortoiliofemoral axis. Palpable distal pulses were restored. A combined surgical and endovascular approach should be considered a viable alternative to laparotomy in selected patients with total juxtarenal aortic occlusion. (*J Vasc Surg* 2005;42:559-63.)

Infrarenal abdominal aortic occlusive disease has traditionally been treated with aortic endarterectomy, aorto-bifemoral bypass grafting, or both; however, it has also been associated with up to a 3.3% to 4.6% perioperative mortality rate and an 8.3% to 13.1% major early complication rate.<sup>1,2</sup> Improvements in medical devices have expanded the range and widened the scope of endovascular procedures, including clinical (avoidance of general anesthesia, shorter hospital stay, lower morbidity and mortality, and reduced cost) and hemodynamic (better hemodynamic results, resistance to elastic recoil, and fewer embolic complications) advantages. Moreover, the “kissing stents” technique was developed to reconstruct the aortoiliac bifurcation. It has been shown to have procedural and clinical success comparable to that of conventional surgery, lower mortality rates, and reported good patency rates in most focal stenosis or occlusion of the aortic carrefour, especially in patients who are considered to have high surgical and anesthesiologic risk.<sup>3-5</sup> However, there have been few data on this technique for total infrarenal aortic occlusion.<sup>6</sup> We report a case of juxtarenal aortoiliac occlusion that was managed by a combined surgical and endovascular approach.

## CASE REPORT

A 53-year-old man was referred to our department of surgery with episodes of severe hypertension, acute-on-chronic renal failure, weight loss, limiting bilateral buttock and thigh claudication after walking 10 to 20 m, and occasional rest pain.

**History of illness.** Over the previous 6 months, he experienced a 15-pound weight loss and had progressive buttock and thigh claudication with recent rest pain. His renal function had progressively deteriorated from a baseline creatinine level of 1.3 to 6.2 mg/dL.

**Medical and surgical history.** He was a chronic heavy smoker and had a significant respiratory history characterized by severe reduction of forced expiratory volume in 1 second due to recurrent episodes of pneumonia, pulmonary fibrosis, and bilateral bullous emphysema. He therefore was evaluated for lung transplantation. His medical history also included chronic anemia, renal insufficiency, gastric ulcers, and pulmonary hypertension; he had recently recovered from enteric infection due to *Enterococcus faecium* D.

**Medications.** The patient was taking nitroprusside and verapamil.

**Physical examination.** On examination, there were no palpable lower limb pulses; he was frail and thin and in no acute respiratory distress. His blood pressure was 160/90 mm Hg bilaterally, and the chest examination revealed wheezing and rales. The cardiac examination revealed a regular rate and rhythm with no gallop; the abdomen was tender, nondistended, and without pulsatile masses. There were revascularization Doppler signs on both posterior tibial arteries; the feet were pale and cool, with slow capillary refill and no ulcerations.

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Competition of interest: none.

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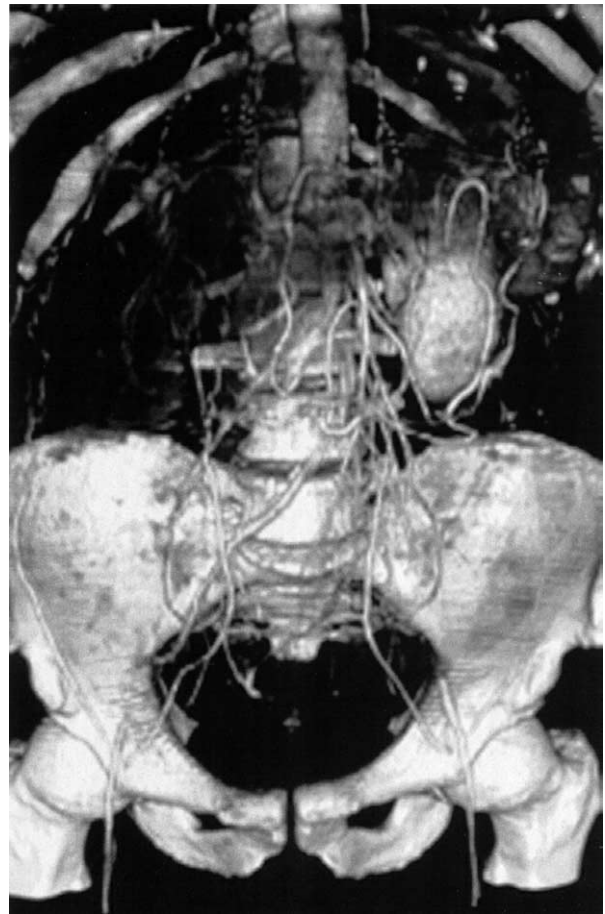
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Imaging studies were performed: a chest radiograph confirmed the bilateral emphysema with pulmonary fibrosis, and an echocardiogram showed hypokinesia of the anterior wall of the left heart and an ejection fraction less than 50% with severe pulmonary hypertension. The ankle-brachial index was 0.40 on the right and 0.48 on the left. Preoperative computed tomography/angiography revealed extensive aortic calcification, with complete calcified occlusion of the infrarenal aorta just below the origin of the renal arteries and a severe stenosis of the left renal artery at its origin (Fig 1). The kidneys were also noted to be atrophic, and there were extensive lumbar, inferior mesenteric, and pelvic collaterals. Both the common and external iliac arteries were occluded, with revascularization of the common femoral arteries at the bifurcation. There was no lymphadenopathy or malignancy. The findings were considered a high risk for anesthesia and were discussed at our multidisciplinary meeting. After discussion with the patient, we decided to manage this situation via an endovascular approach to stent the aorta and both the iliac arteries after a remote surgical access to the femoral artery bilaterally.

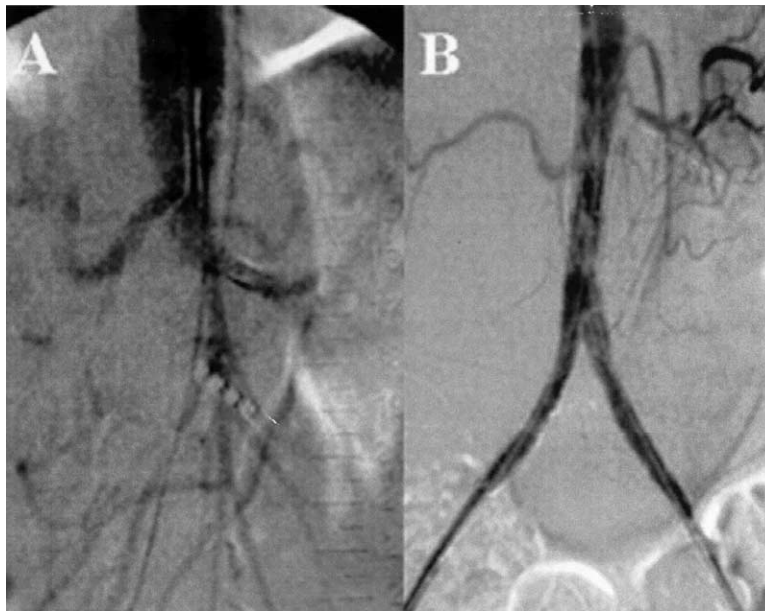
**Surgical treatment.** The surgical management involved generally accepted steps for open repair: blood samples for routine laboratory studies and cross-matched packed red blood cells, central venous and bladder catheters, a peripheral 14-gauge vein access, and radial artery cannulation for continuous monitoring of blood pressure. The patient was draped as for open repair, with the fluoroscopic machine (Isocentric Mobile C-Arm; Siemens, Munich, Germany) opposite from the first operator. We used autotransfusion (Compact-Dideco, Modena, Italy) and a fluid protocol (5% mannitol, dopamine  $3 \mu\text{g} \times \text{kg}^{-1} \times \text{min}^{-1}$ , and *N*-acetylcysteine 600 mg intravenously) against the ischemic-related delivery of free radicals and the renal damage due to the contrast medium. Short-term antibiotic prophylaxis with cefazolin (2 g twice daily) was used. Through percutaneous left brachial artery access, digital subtraction angiography (DSA) confirmed the total occlusion of the juxtarenal aorta just below the origin of the renal arteries, the severe stenosis of the left renal artery, and the occlusion of both iliac arteries; the common femoral arteries were seen to refill via collaterals bilaterally. The common femoral artery was exposed bilaterally, a bolus of 2500 U of heparin was administered intravenously, and bilateral remote endarterectomy of the common and external iliac arteries by using a Völlmar ring stripper was performed to more easily negotiate the occlusion with a 0.035-Terumo guidewire (Terumo Corporation; Frankfurt, Germany).

Thereafter, DSA control revealed the revascularization of the iliac arteries and detected multiple short-segment dissections due to several previously attempted catheterizations. The stenosis of the right renal artery was treated with primary stenting by using a self-expandable device (Cordis Corporation, Miami, Fla). In the infrarenal aorta, two Palmaz stents (Cordis) were deployed in the proximal abdominal aorta, with the upper end overlapping slightly with the renal artery origin. Afterward, over a 0.035-



**Fig 1.** Preoperative computed tomography/angiography showed total occlusion of the juxtarenal aorta and extensive lumbar, pelvic, and mesenteric collateral vessels.

Terumo guidewire, the crossover allowed us to lay two straight catheters to perform a kissing-stents technique with three self-expandable stents (Luminexx; Bard, Murray Hill, NJ) to cover each common and external iliac artery bilaterally (Fig 2). We completed the hybrid procedure with thrombectomy of the femoropopliteal arteries; both femoral bifurcations were closed with a Dacron patch angioplasty (Bard). Final DSA confirmed that all stents were well expanded with no dominant stricture. There was a dramatic result after the procedure, with all peripheral pulses bilaterally restored. The postoperative ankle-brachial index improved to 0.8 bilaterally, and the patient's symptoms disappeared. He was initially treated with intravenous heparin (22,000 IU/24 h) for 72 hours and thereafter with low-weight-molecular heparin. The serum urea and creatinine levels never altered. The postoperative course was uneventful. The patient did not complain of bowel complications, was regularly discharged 12 days after the intervention, and was assessed in the physiokinetic outpatient clinic. He was last seen 6 months later, at which time claudication had disappeared and he had a palpable femoral pulse; com-



**Fig 2.** Intraoperative DSA. **A**, A crossover technique was used to prepare for the kissing-stents procedure after remote endarterectomy of the iliac and femoral vessels. **B**, The final angiographic control confirmed the successful revascularization of the entire aortoiliac bifurcation bilaterally.



**Fig 3.** Two-month follow-up control: computed tomography/angiography with three-dimensional reconstructions detailed the reconstruction of the occluded vessels.

puted tomography/angiography control confirmed the complete reconstruction of the aortoiliac districts bilaterally (Fig 3).

## DISCUSSION

Obstructive disease of the infrarenal aorta usually presents as an isolated aortic occlusion with involvement of the aortoiliac bifurcation.<sup>7</sup> Previous series have suggested that long-term survival rates are adversely affected when occlusion involves the juxtarenal aorta, with improved survival rates in patients treated with surgery: the survival rate of patients who underwent an operation was approximately 65% at 5 years and 40% at 10 years.<sup>1,2,8</sup> In our case, this challenging patient had advanced multilevel atherosclerosis; his weight loss and disabling claudication were related to severe respiratory failure and enteric infection and total occlusion of the infrarenal and iliac arteries bilaterally, whereas his ischemic nephropathy and severe hypertension was attributed to severe renovascular disease.

A conventional aortic reconstructive procedure was contraindicated in this high-risk patient awaiting lung transplantation; in addition, most of the reported experiences have dealt with focal stenoses, such as type D lesions according to the TASC (Transatlantic inter-Society Consensus) classification. Scientific information on management of complex aortic lesions is still lacking.<sup>4,5,9</sup> Several pioneering centers studied the treatment of aortic occlusions in 29 patients and reported a 100% cumulative primary rate at 5 years.<sup>6</sup> Despite the paucity of long-term follow-up results for stenting in total aortic occlusion, we consider this approach most appropriate for patients

deemed at high operative risk for conventional repair<sup>4,10,11</sup>; our patient was not a candidate for general anesthesia and open conventional surgery, with good chances of cardiorespiratory impairment because of severe chronic respiratory insufficiency that made him a candidate for lung transplantation. Only two relatively recent series attempted to determine the risk of retrograde propagation of thrombus when infrarenal aortic occlusion is present.<sup>12,13</sup> Among postulated factors that reduce flow through the aortic stump and subsequently could increase the risk of suprarenal thrombus extension, renal artery occlusive disease is the most frequent finding.<sup>14,15</sup> Many articles have been published on thrombus propagation to the juxtarenal/suprarenal position that resulted in renal dysfunction and mesenteric compromise, followed by death.<sup>14-16</sup>

Clinically significant deterioration in renal function was noted in our patient (ie, no need for dialysis), who was originally admitted to our hospital with severe hypertension and dyspnea. Renal artery stenosis was detected at the initial DSA evaluation and seemed to be at a greater risk of retrograde aortic thrombosis. We believed that it was most appropriate for concomitant aortic and renal artery repair to be undertaken. Percutaneous transluminal angioplasty stenting of the critical stenosis at the origin of the diseased renal artery improved both renal insufficiency and hypertension, thus allowing us to perform a prolonged endovascular procedure to reduce the potential renal damage due to the contrast medium.

Abdominal aortic occlusive disease has historically been treated surgically with aortic endarterectomy, aortofemoral bypass, or both, with effective patency rates. However, the best approach to complex aortoiliac disease still remains controversial in high-risk patients because conventional surgery had been burdened with significant morbidity and mortality as the result of higher cardiopulmonary stress, more extensive exposure, and an increased risk of complications.<sup>1,2,8,17</sup>

Previous articles highlighted that infrainguinal arterial runoff is a focal point for aortic reconstructive procedures: inflow procedures could achieve significantly greater clinical and patency results, particularly when the concomitant occlusion involved iliac and femoral arteries.<sup>18</sup> In fact, one possible reason that stenting alone in complex aortoiliac artery occlusive disease often fails to achieve good long-term patency is concomitant occlusive disease in the common femoral and profunda femoral arteries, which cannot be easily dealt with percutaneous techniques.<sup>19</sup> An inline alternative, such as endovascular treatment, is therefore attractive because it avoids some of the limitations of an extra-anatomic graft and can be approached through a groin incision.<sup>20</sup> A recent report demonstrated 97% assisted primary patency at 1 year with a technique that combines a standard, self-expanding stent in the iliac artery with common femoral endarterectomy.<sup>21</sup> A combined open and endovascular approach could offer the best features of either approach alone, and the results of procedures performed in the operating room are favorable: the combined approach limited the extent of the operation without compromising the comprehensiveness of the revasculariza-

tion.<sup>22</sup> The surgical approach simplified the endovascular technique of flushing atherosclerotic debris from the femoral artery before guidewire access; this is required in some cases when occluded iliac artery segments cannot be crossed with a guidewire, particularly with long-segment occlusions that are densely calcified or with excessive tortuosity.<sup>23,24</sup> Moreover, for patients with severe external iliac disease that extends to the inguinal ligament, the arteriotomy can be performed proximally, and this enables additional working room for the introducer sheath during treatment of distal iliac lesions.<sup>22,24</sup>

In this case, occlusion involved the iliac arteries and the common femoral artery bilaterally, with involvement of the origin of the profunda femoris. The operation was performed in a combined shape to provide afterload reduction for myocardium, thus avoiding an eventual high aortic clamp if open conventional surgery had to be performed, and to improve lower extremity circulation, thus optimizing the long-term patency of the kissing-stents technique. The most important technical point was initially endarterectomy before the placement of the guidewire for the interventional component. We used a contralateral up-and-over approach to cross the lesion with extensive external iliac artery disease. The ipsilateral approach greatly facilitates the positioning of these moderately large-caliber sheaths and devices. This is particularly helpful in proximal common iliac occlusive disease that requires multiple stents. The Palmaz stent was selected because we generally prefer to use balloon-expandable steel stents for aortic disease when highly accurate placement is required and when the obstruction involves high-grade calcification, because of their greater radial force.<sup>10,25</sup>

Reviewing the available literature, when compared with open surgery, despite disappointing results with the kissing-stents technique,<sup>18,26</sup> in the short term, aortoiliac stenting seems to be associated with a similar patency rate, with lower morbidity and mortality. Among 700 cases reviewed, only 1 case of aortic rupture was reported and occurred in 1986.<sup>3-5</sup> A primary angiographic patency rate at 1 month showed a success rate of 100% in several series, and several authors reported on a primary and secondary cumulative patency at 36 months of 90% and 98%.<sup>3,4,7,25,26</sup> In our experience, out of 148 cases of endovascular treatment for aortoiliac occlusive disease, we reported a 94% of patency rate at a mean follow-up of 19 months. The present case had a dramatic radiologic and clinical result; since then, computed tomography/angiography control 2 months after the procedure confirmed the excellent radiologic result with complete revascularization of the aortoiliac segment, at which time the patient had palpable femoral, tibial and pedal, artery pulses and no claudication.

This procedure effectively limits the extent of surgical exposure necessary to provide complete revascularization, thus resulting in minimal morbidity and mortality. The kissing-stents technique offers an invaluable method for treating disease in the infrarenal aorta or common iliac arteries that might otherwise require surgical intervention,



with excellent technical and clinical success, especially for high-risk patients.

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